Stormwater Management Manual for Western Washington Case Studies

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Presentation Ground Rules

- Walk through development of a Stormwater Site Plan (SSP)
- Focus on Process, <u>not</u> Design Details
- Simplify Project
- Others may use different BMPs or Flow Control



Two Case Studies

- New Development (Residential)
- Redevelopment (Commercial)



Prepare SSP (MR #1, Section 2.5.1) (Vol. 1, Chapter 3)

- 1. Collect and Analyze Information on Existing Conditions (3.1.1.)
- 2. Prepare Preliminary Development Layout (3.1.2)
- 3. Perform Off-site Analysis (at local governments option) (3.1.3)
- 4. Determine Applicable Minimum Requirements (3.1.4)

Prepare SSP (cont.)

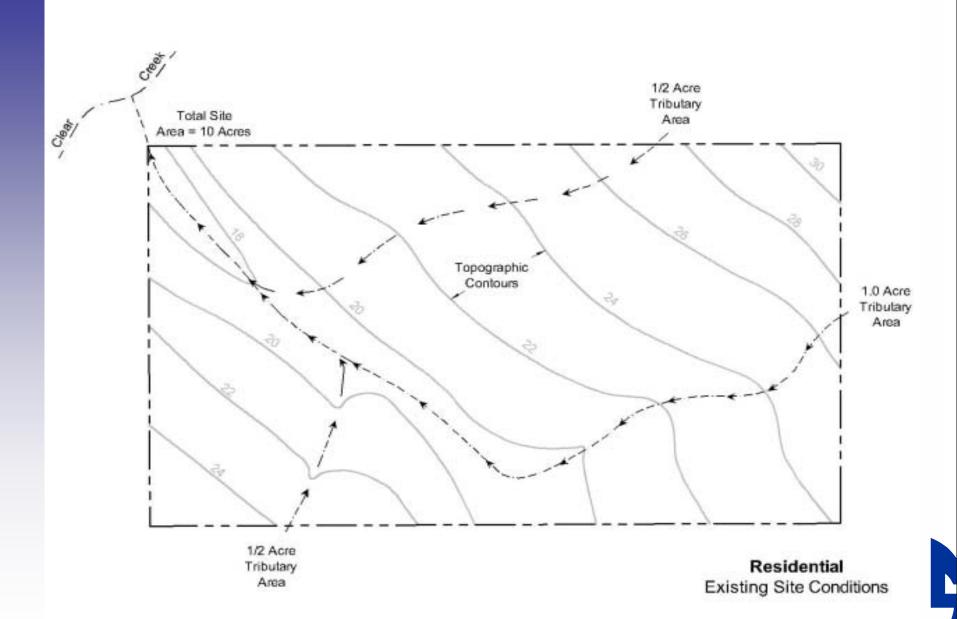
- 5. Prepare a Permanent Stormwater Control Plan (3.1.4)
- 6. Prepare a Construction Stormwater Pollution Prevention Plan (SWPPP) (3.1.5)
- 7. Complete the Stormwater Site Plan (3.1.6)
- 8. Check Compliance with all applicable Minimum Requirements (3.1.7)



Step 1: Existing Conditions (Section 3.1.1)

- Identify Site Limitations
 - High Erosion Potential
 - Sensitive and Critical Waters
- Prepare an "Existing Conditions Summary"





Step 2: Preliminary Development Layout (Section 3.1.2)

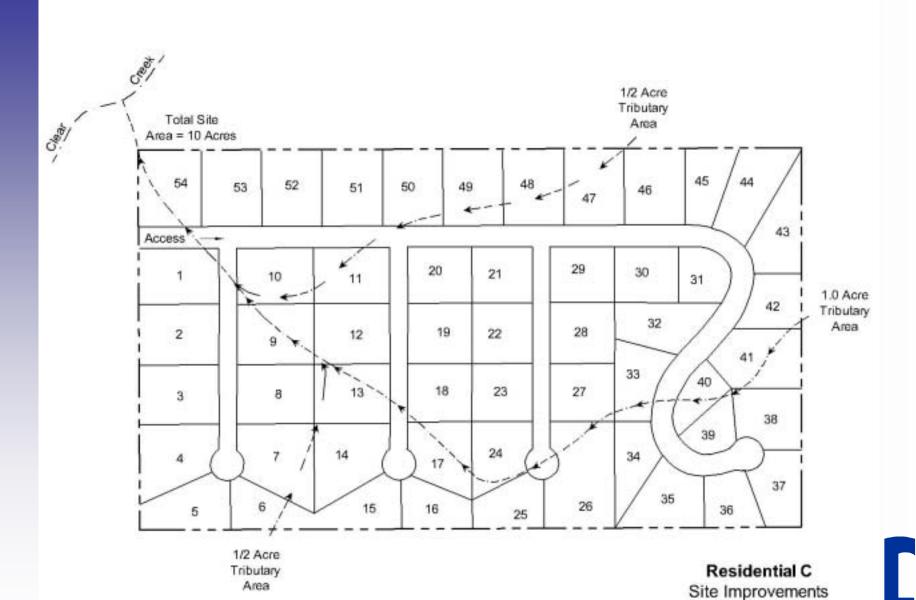
- Locate Buildings, roads, parking lots, and landscaping features
 - Fit terrain
 - Preserve natural vegetation
 - Cluster buildings
 - Maintain/utilize natural drainage patterns
- Prepare Site Plan



Preservation of Natural Drainage Systems and Outfalls (MR #4)

- Section 2.5.4: Preserve natural drainage systems and outfalls
 - Runoff from site "must not cause significant adverse impact to downstream receiving waters"
 - All outfalls require energy dissipation
 - See Vol. 5, Section 4.5.3
- Could have greenbelt along channel
- Will have outlet protection at single outlet





Step 3: Offsite Analysis (Section 3.1.3)

- Recommendation, not requirement of Ecology
- Local Governments to determine
- Optional Guidance #2 (Vol. I, Section 2.6.2)

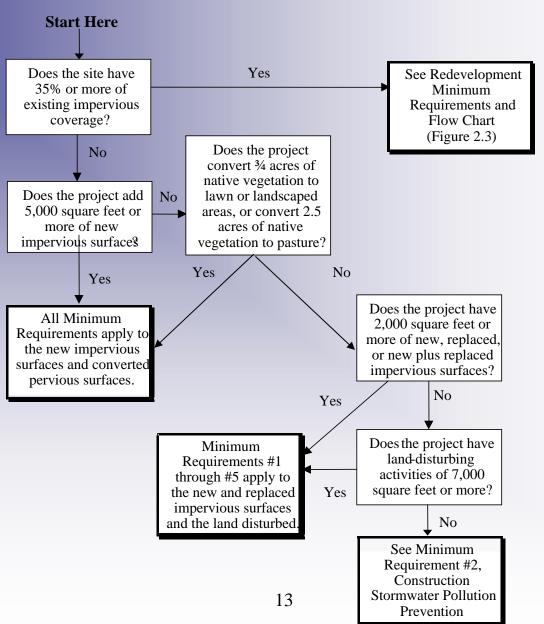


Step 4: Determine Applicable Minimum Requirements (Section 3.1.4)

• See Vol. I, Table 2.2



Figure 2.2 Flow Chart for Determining Requirements for New Development





Step 5: Prepare Permanent Stormwater Control Plan (Section 3.1.5)

- Presented in detail in Vol I, Chapter 4
- Containing the following sections
 - Existing and developed site hydrology
 - Performance standards and goals
 - Flow control and water quality systems
 - Conveyance system analysis



Permanent Stormwater Control Plan (Section 4.2)

- I. Determine and read applicable Minimum Requirements
- II. Select Source Control BMPs (note residential may skip)
- III. Determine Threshold Discharge Areas
- IV. Select Flow Control BMPs and Facilities
- V. Select Treatment Facilities
- VI. Review selection of BMPs and Facilities
- VII. Complete Development of Permanent Stormwater Control Plan



Step I. Determine and read applicable Minimum Requirements

• Reminder, duplicate of Step 4

- Completed above, MR #1 through #10 are appropriate for this project
- Will need to run WWHM



Wetlands Protection (MR #8)

- Section 2.5.8
- Meet standards in addition to treatment requirements in MR #6
- Appendix 1-D contains information on wetland discharges
- Not discharging to wetlands on this project



Basin/Watershed Planning (MR #9)

- Section 2.5.9
- More stringent requirements may be placed on a project due to individual basin/watershed plans
- Project must meet the additional requirements
- No special basin/watershed plan for this project



Step II. Select Source Control BMPs (MR #3)

- Section 2.5.3
- Primarily directed toward Commercial/Industrial development
- Volume IV is dedicated to this MR
- Residential developments may skip

None used in this project



Step III. Determine Threshold Discharge Areas

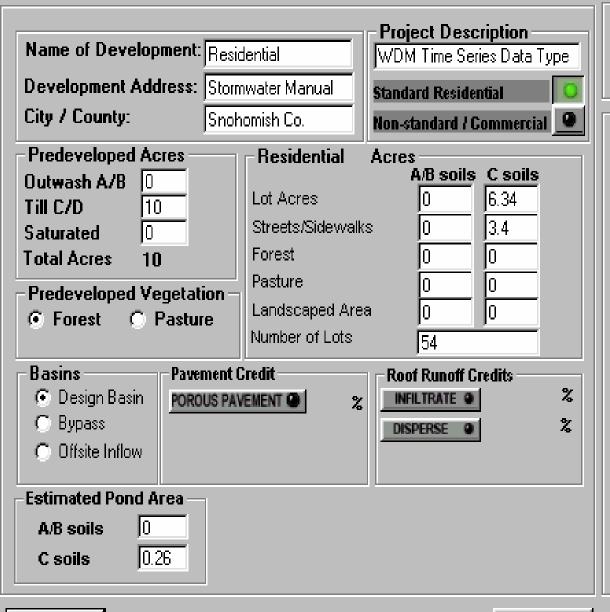
- All Minimum Requirements have thresholds that determine whether they are to be applied or not
- Use Tables 2.1 (Treatment) and 2.2 (Flow)

- PGIS = 3.4 acres (148,000 sq ft)
- 100 year flow increase 6.4 cfs (WWHM)
- Project requires both treatment and flow control

Step IV. Select Flow Control BMPs and Facilities (MR #7)

- Section 2.5.7
- Match developed discharge durations to predevelopment durations for the range of discharge rates from 50% of the 2-year up to the full 50-year peak flow.





Western Washington Hydrology Model

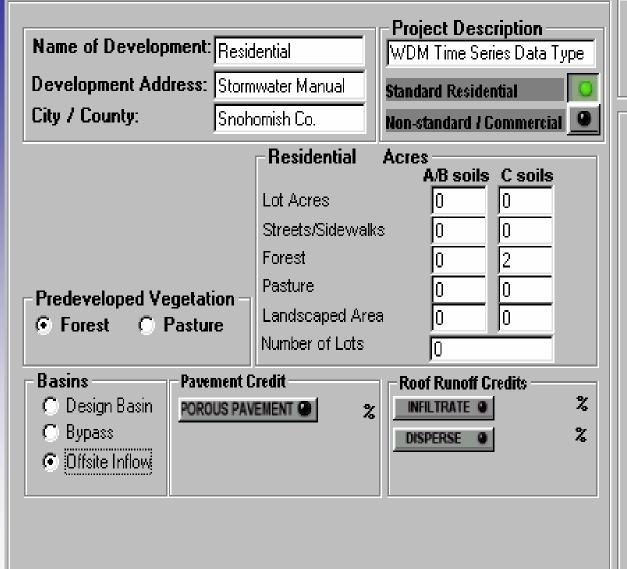
Step 2

Fill in site information and list acres for each type of development.

On-Site Stormwater Management (MR #5)

- Section 2.5.5
- Infiltrate, disperse, and/or retain stormwater runoff onsite
- Specific BMPs discussed in Volumes III and V
- Roof downspout control BMPs
- Downspout infiltration system (Vol. III, 3.1.1)

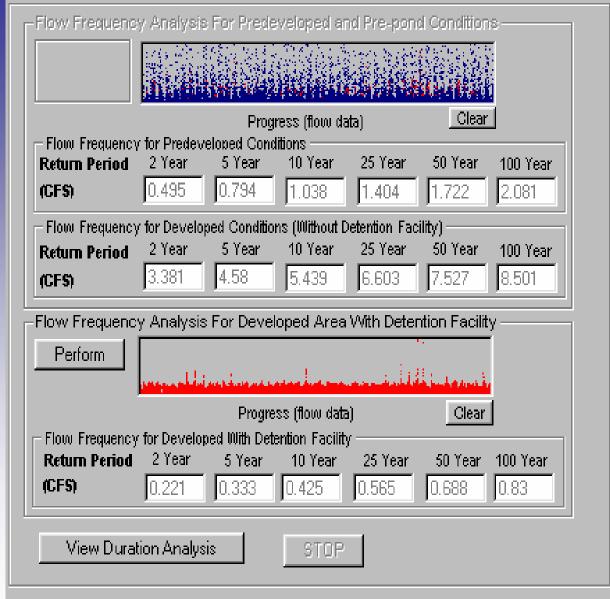
Downspout dispersal systems (Vol. III, 3.1.2 and Vol. V, 5.3.1)



Western Washington Hydrology Model

Step 2:

Fill in site information and list acres for each type of development.



Western Washington Hydrology Model

Step 7

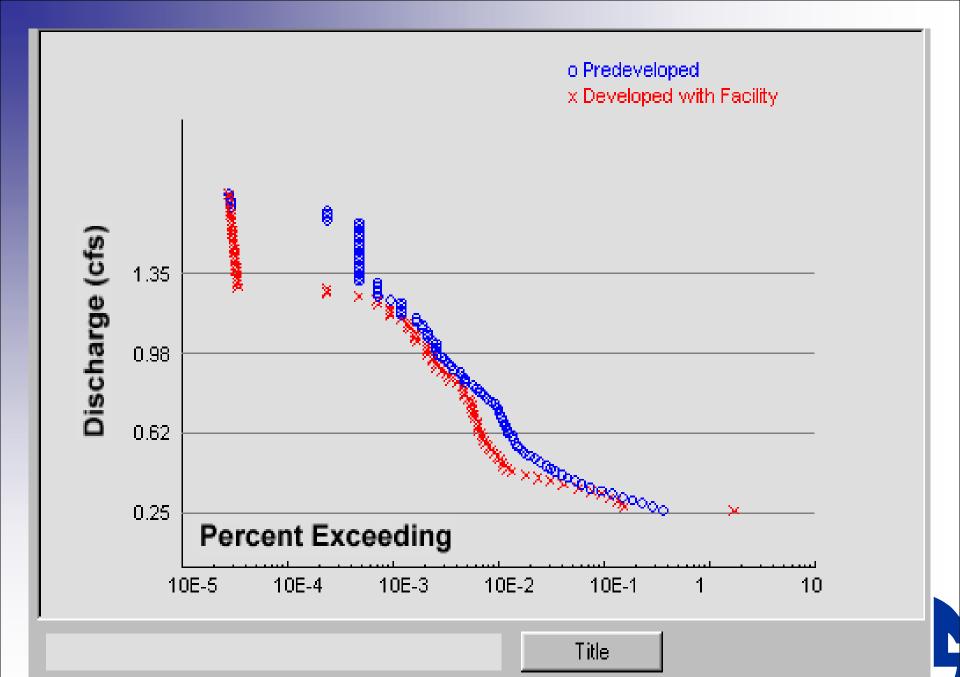
Compare statistics.

Ecology Manual Hydrology Standard (1):

Stormwater discharges to streams shall match developed discharge duration to predeveloped durations for the range of predeveloped discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. In addition, the developed peak discharge rates shall not exceed the predeveloped peak discharge rates for 2- and 10- year return periods.



Next->



Flow Control Results

- Standard Detention pond (Vol. III, Section 3.2.1) 200' x 60', 10' deep
- Multiple orifice restrictor Control Structure (Vol. III, Section 3.2.4) 24" riser with 1.75", 2.5", and 5.25" openings at 0', 6.25', and 7.5' levels
- 2-year, 24-hour discharge 0.221 cfs



WWHM Output

- Use reports that model produces as attachments to report
- Volume I, page 3-5 lists required submittals



Step V. Select Treatment Facilities (MR #6)

- Section 2.5.6
- Select treatment facility from Volume I, Chapter 4, Figure 4.1 and Vol. V, Chapter 2
- Specific criteria for Flowchart listed in text (Section 4.2)
- Additional factors for selection are discussed in Vol. V, Section 2.2



On-Site Stormwater Management (MR #5)

- Section 2.5.5
- Infiltrate, disperse, and/or retain stormwater runoff onsite
- Specific BMPs discussed in Volumes III and V
- Roof downspout control BMPs
- Downspout infiltration system (Vol. III, 3.1.1)

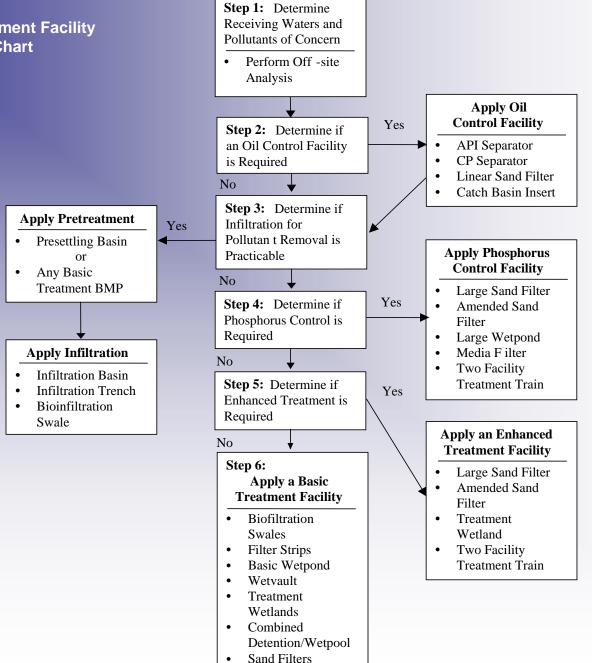
Downspout dispersal systems (Vol. III, 3.1.2 and Vol. V, 5.3.1)

Runoff Treatment (cont.)

Figure 4.1 of Volume I



Figure 4.1 Treatment Facility Selection Flow Chart





Sand Filter Sizing

Residential Property Sand Filter Sizing Calculations

(Vol. V, Section 8.6 and BMP T8.10)

0.221 Design Flow rate (cfs) Based on the full 2-year, 24-hour rate from the detention pond Calculated in WWHM (Vol. I, page 2-27)

Calculation of Sand Filter surface area (sq ft)

 $Qs = K^*I^*A_{sf}$ where i=(h+L)/L

Asf = Q_{sf}/K^*i from Page 8-15 Vol V

2 K (ft/day) Hydraulic conductivity (given by Ecology)

0.221 Q_{sf} (cu ft/sec)

19,094 Q_{sf} (cu ft/day)

1 h (ft) water depth above top of filter

1.5 L (ft) sand bed depth (given by Ecology)

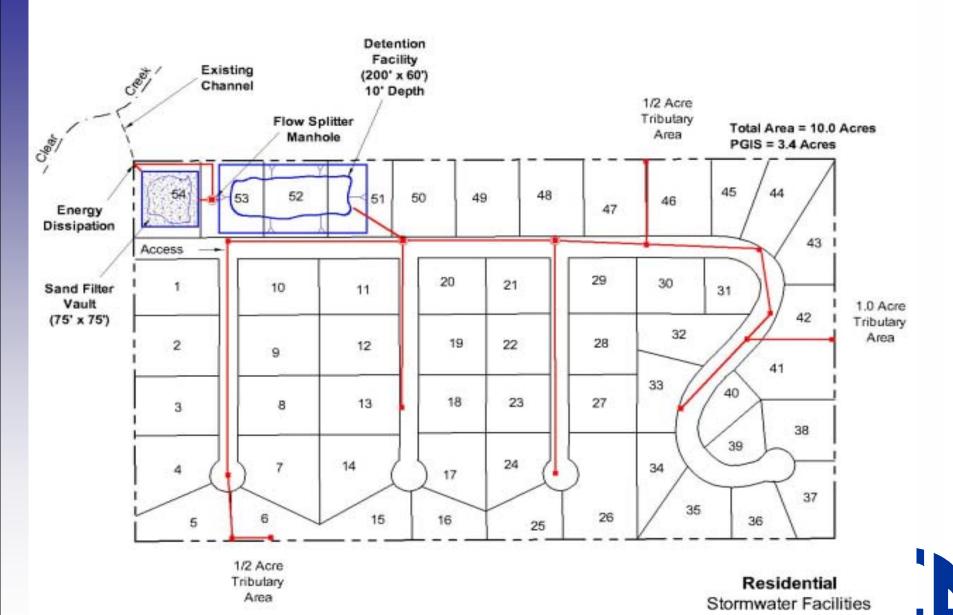
1.67 i (ft/ft) hydraulic gradient of pond

3.67 F (ft/day) Filtration rate = K*i

5,207.56 sq ft Asf based on Asf = Qsf/K*i

72.16 ft length of side for square sand filter





Step VI. Review selection of BMPs and Facilities



Step VII. Complete Development of Permanent Stormwater Control Plan (MR #10)

- Section 2.5.10
- Prepare operations and maintenance manual for treatment and flow control facilities
- Chapter 4, Vol. V has guidance



Prepare SSP (Revisited)

- 1 Collect and Analyze Information on Existing Conditions
- 2 Prepare Preliminary Development Layout
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- 8 Check Compliance with all applicable Minimum Requirements

Step 6: Construction Stormwater Pollution Prevention Plan (SWPPP) (MR #2)

- Section 2.5.2
- Required on all projects passing minimum thresholds
- Consists of 12 Elements
- Volume II, Chapter 3 is dedicated to this Minimum Requirement
- Not walking through elements here



Step 7: Complete the Stormwater Site Plan

- Described in Vol. I, Section 3.1.7
 - Project Overview
 - Existing Conditions Summary
 - Offsite Analysis
 - Permanent Stormwater Control Plan
 - Special Reports and Other Permits
 - O & M Manual
 - Bond Quantities Worksheet



Step 8: Check Compliance with all applicable Minimum Requirements



Questions???



Changes to project with A/B soil instead of C/D soil

- Much less predevelopment runoff
- Type A release rate is very low
- Must use infiltration on Site and for all Flow Control facilities
- Minimum Requirement #5 (Onsite stormwater management) is very important



Let's all take a Short Break

